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OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

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BULLOCK, IN SUK C	

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oblonpat@oblon.com
jgardner@oblon.com

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SHAHRAM MIHAN
and ZHEIKO MAAS

Appeal 2009-0870
Application 10/506,602
Technology Center 1700

Decided:[1] March 26, 2009

Before EDWARD C. KIMLIN, ADRIENE LEPIANE HANLON, and MICHAEL P. COLAIANNI, *Administrative Patent Judges*.

HANLON, *Administrative Patent Judge*.

DECISION ON APPEAL

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[1] The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, begins to run from the Decided Date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or Notification Date (electronic delivery).

A. STATEMENT OF THE CASE

This is an appeal under 35 U.S.C. § 134 from an Examiner's decision rejecting claims 1-3 and 5-20 under 35 U.S.C. § 103(a) as unpatentable over Maas.[2,3] We have jurisdiction under 35 U.S.C. § 6(b). We AFFIRM.

The claims on appeal are directed to a process for the oligomerization of α-olefins wherein the olefin is brought into contact with a specific catalyst system. Claim 1, reproduced below, is the only independent claim on appeal:

> 1. A process for the oligomerization of α-olefins having at least three carbon atoms, in which the olefin is brought into contact with a catalyst system obtainable from
>
> a) at least one chromium source;
>
> b) at least one ligand comprising 1,3,5-tri-n-dodecyl-1,3,5-triazacyclohexane; and
>
> c) at least one activator comprising a boron compound, with the molar ratio of B:Cr being at least 5.

App. Br., Claims Appendix.[4]

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[2] WO 00/58319 published October 5, 2000. An English translation of this document is of record in the official file of the instant application and is attached hereto. We refer to that translation in this opinion. We note that when referring to WO 00/58319 in the Appeal Brief and Reply Brief, the Appellants cite to portions of US 6,844,290 B1 to Maas. It appears that the disclosure of WO 00/58319 and US 6,844,290 B1 are substantially the same.

[3] In the Examiner's Answer, the Examiner withdrew the rejection of claims 1-3 and 5-20 under 35 U.S.C. § 102(b) as anticipated by Maas. Examiner's Answer dated February 7, 2008 ("Ans."), at 2.

[4] Appeal Brief dated November 13, 2007.

The Appellants argue the patentability of claims 1-3 and 5-20 as a group. *See* App. Br. 7. Thus, we decide the appeal on the basis of independent claim 1. *See* 37 C.F.R. § 41.37(c)(1)(vii) (2007).

B. ISSUES

Issue (1): Have the Appellants shown that the Examiner reversibly erred in concluding that the claimed catalyst system would have been prima facie obvious in view of Maas?

Issue (2): On balance, does the evidence of record, including Maas and the Appellants' objective evidence of non-obviousness, weigh in favor of a determination that the subject matter of claim 1 is patentable over Maas?

C. FINDINGS OF FACT

The following findings of fact are supported by a preponderance of the evidence. Additional findings of fact as necessary appear in the Analysis portion of the opinion.

Maas

The invention disclosed in Maas relates to an oligomerization catalyst obtainable from:

a) a chromium compound CrX_3 and at least an equimolar amount, based on the chromium compound CrX_3, of a ligand L or an existing chromium complex CrX_3L, in which the groups X are, independently of one another, abstractable counterions and L is a 1,3,5-triazacyclohexane of formula I, and

b) at least one activating additive.

Maas 4:2-10.

The invention also relates to a process for preparing oligomers of olefins using these catalysts. Maas 4:11-12.

Maas discloses that the properties of the catalyst can be influenced by varying the substituents on the 1,3,5-triazacyclohexane ring. Maas 6:17-18.

Maas discloses that the following five (5) 1,3,5-triazacyclohexanes are "especially preferably":

1,3,5-tri-n-octyl-1,3,5-triazacyclohexane,
1,3,5-tri-n-dodecyl-1,3,5-triazacyclohexane,
1,3,5-tribenzyl-1,3,5-triazacyclohexane,
1,3,5-tris-(2-ethylhexyl)-1,3,5-triazacyclohexane,
1,3,5-tris-(2-n-propylheptyl)-1,3,5-triazacyclohexane.

Maas 8:7-10.

Maas also discloses that the following three (3) activating additives are preferred: (1) an optionally substituted five-member aromatic N-heterocycle and at least one aluminumalkyl, (2) an alkylalumoxane, and (3) at least one boron compound and at least one aluminum alkyl. Maas 12:8-10, 14:15-16, 16:7-9.

Mass discloses several preferred boron compounds. Maas 16:15-17.

According to Maas, the amount of the activating boron compound used is dependent on its nature. The ratio of chromium compound CrX_3 or chromium complex CrX_3L to the activating boron compound is generally from 1:0.1 to 1:10,000, preferably from 1:1 to 1:1,000. Maas 16:18-20.

Maas discloses that the oligomerization catalysts of the present invention make it possible to obtain oligomers of olefins in high yields with a low fraction of by-products. Maas 6:3-5.

D. PRINCIPLES OF LAW

A claimed invention is not patentable if the subject matter of the invention would have been obvious to a person having ordinary skill in the art at the time the invention was made. 35 U.S.C. § 103(a); *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1734 (2007); *Graham v. John Deere Co.*, 383 U.S. 1, 13 (1966).

Facts relevant to a determination of obviousness include (1) the scope and content of the prior art, (2) any differences between the claimed invention and the prior art, (3) the level of skill in the art, and (4) any relevant objective evidence of obviousness or non-obviousness. *KSR*, 127 S. Ct. at 1734; *Graham*, 383 U.S. at 17-18.

Where the difference between the claimed invention and the prior art is some range, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range. *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990).

In order for a showing of "unexpected results" to be probative evidence of non-obviousness, it falls upon the applicant to at least establish: (1) that there actually is a difference between the results obtained through the claimed invention and those of the prior art; and (2) that the difference actually obtained would not have been expected by one skilled in the art at the time of invention. *In re Freeman*, 474 F.2d 1318, 1324 (CCPA 1973).

"[O]bjective evidence of nonobviousness must be commensurate in scope with the claims." *In re Lindner*, 457 F.2d 506, 508 (CCPA 1972).

Furthermore, an applicant relying on comparative tests to rebut a prima facie case of obviousness must compare the claimed invention to the closest prior art. *In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984).

If rebuttal evidence of adequate weight is produced, the holding of prima facie obviousness is dissipated and all of the evidence is considered anew. *In re Piasecki*, 745 F.2d 1468, 1472 (Fed. Cir. 1984).

E. ANALYSIS

1. Issue (1)

The Examiner found that Maas expressly teaches the catalytic components recited in claim 1. In particular, the Examiner found that Maas discloses a catalyst obtainable from:

> (a) a chromium compound (col. 1, lines 6-8), (b) a 1,3,5-triazacyclohexane ligand (col. 1, lines 12-13), and (c) at least one activating additive (col. 1, line 30). Maas, further, explicitly discloses 1,3,5-tri-n-dodecyl-1,3,5-triazacyclohexane as one of five particularly preferred 1,3,5-triazacyclohexanes (col. 3, lines 12-26; emphasis added by the Examiner). Maas, also, discloses only two combination[s] of activating additives with one of the two being at least one boron compound and at least one aluminum alkyl (col. 7, lines 54-58).

Ans. 4-5.

The Examiner found that Maas discloses a limited number of possible combinations of "particularly preferred" 1,3,5-triazacyclohexanes and activating additives, one of which falls within the scope of claim 1. Ans. 5. The Examiner also found that Maas discloses a molar ratio of boron to chromium that overlaps the claimed range, i.e., "at least 5." Ans. 4. Thus, the Examiner concluded that the claimed catalyst would have been prima facie obvious in view of Maas.

The Appellants recognize:

> *Maas* does, in fact, disclose that catalysts can separately include chromium compounds CrX_3 (*see* column 4, line 51 to column 5, line 4), 1,3,5-tri-n-dodecyl-1,3,5-triazacyclohexane (*see* column 3, lines 22 to 23), and a boron compound (*see* column 7, line 54 to column 8, line 4).

App. Br. 4.

Nonetheless, the Appellants argue that the Examiner has failed to demonstrate why one of ordinary skill in the art would have been motivated to select the particular combination of components recited in claim 1 from the numerous chromium compounds, 1,3,5-triazacyclohexanes, and activating additives disclosed in Maas. App. Br. 4; Reply Br. 2.[5] In addition, the Appellants argue that Maas would not have guided one of ordinary skill in the art to select a B:Cr molar ratio within the range recited in claim 1. Reply Br. 2.

The Appellants' arguments are not persuasive of reversible error. Maas discloses a catalyst obtainable from a chromium source, a 1,3,5-triazacyclohexane, and at least one activating additive. Maas 4:2-10. We recognize that Maas discloses a number of 1,3,5-triazacyclohexane compounds and activating additives. *See, e.g.,* Maas 7:1-10, 12:8-16:17. However, Maas also discloses a limited class of catalysts obtainable from one of five (5) especially preferred 1,3,5-triazacyclohexanes and one of three (3) preferred classes of activating additives. Maas 8:7-10; 16:7-9. This limited class consists of fifteen (15) catalysts.

We find that one of ordinary skill in the art would have immediately envisaged each catalyst of this limited class, which includes a catalyst within

[5] Reply Brief dated April 7, 2008.

the scope of claim 1 (i.e., a catalyst obtainable from a chromium source, a 1,3,5-tri-n-dodecyl-1,3,5-triazacyclohexane, and an activator comprising a boron compound). *See In re Schaumann*, 572 F.2d 312, 316-17 (CCPA 1978) (disclosure, embracing very limited number of compounds, provides a description of those compounds just as surely as if they were identified by name); *In re Petering*, 301 F.2d 676, 681 (CCPA 1962) (disclosure describes not only a broad class but also a much more limited class within the broad class; one skilled in the art would, on reading the disclosure, at once envisage each member of this limited class).

As for the recited "molar ratio of B:Cr being at least 5," the Appellants have not pointed to any error in the Examiner's finding that Maas discloses a molar ratio of B:Cr that overlaps this range. Thus, the Appellants must show that the claimed range is critical. *Woodruff*, 919 F.2d at 1578.

In sum, the Appellants have not shown that the Examiner reversibly erred in concluding that the claimed catalyst system would have been prima facie obvious in view of Maas.

2. Issue (2)

In an attempt to rebut the prima facie case of obviousness, the Appellants argue that Examples in the Appellants' Specification demonstrate that catalysts according to the present invention provide superior results relative to the catalysts of Maas. In particular, the Appellants compare the results of Examples 1 and 2 with the results of Comparative Examples 3 and 4 reported in the Table on page 6 of the Specification and argue that the claimed catalysts provide "superior results." App. Br. 5-6.

The Table is reproduced below:

Table

Ex.	Cat [μmol]	DMAB*	TIBAL**	DEAC**	Activity $kgC_{12}/molCr/h$
1	39.4	10	50	5	203
2	38.5	10	50	-	195
3***	40.6	2	50	-	130
4***	38.1	10	50	-	67

* Molar ratio of B:Cr
** Molar ratio of Al:Cr
*** Comparative examples

Spec. 6.

According to the Specification, 1-Butene was oligomerized using each of the catalyst systems in Examples 1 and 2 and Comparative Examples 3 and 4. Spec. 6:7-8.

Examples 1 and 2 and Comparative Example 3 used [(1,3,5-tri-n-dodecyl-1,3,5-triazacyclohexane)$CrCl_3$], and Comparative Example 4 used [(1,3,5-tris(2-ethylhexyl)-1,3,5-triazacyclohexane) $CrCl_3$]. Spec. 5:42-45. According to the Appellants, Comparative Example 4 corresponds to Maas Example 21. Spec. 5:45; App. Br. 5.

The same boron compound was used in each of the examples, i.e., dimethylanilinium tetrakis(pentafluorophenyl)borate (DMAB). Spec. 6:1-3.

We make the following observations regarding the results reported in the Table:

1. The Appellants have failed to direct us to any evidence establishing that the activity reported in the Table would have been unexpected. *Freeman*, 474 F.2d at 1324.

2. The Appellants have failed to demonstrate that the evidence is commensurate in scope with the claims. In particular, claim 1 recites a process for the oligomerization of a number of α-olefins, i.e., α-olefins having at least three carbon atoms. *See* Spec. 5:10-15. However, the Table only reports the results of oligomerizing a single α-olefin (1-butene).

Likewise, the claimed catalyst system encompasses a wide range of chromium sources and boron compounds as well as a broad molar ratio of B:Cr, i.e. "at least 5." *See, e.g.*, Spec. 3:5-13, 4:4-13. However, the examples said to embody the claimed invention (Examples 1 and 2) only use a catalyst system obtained from a single chromium source ($CrCl_3$) and a single boron compound (DMAB) with one B:Cr molar ratio (10).

The Appellants argue that "the nonobviousness of a genus can be supported by data showing unexpected results for a species." The Appellants cite *In re Kollman*, 595 F.2d 48 (CCPA 1979) for support. Reply Br. 4.

In *Kollman*, the Court explained:

> We feel that the obviousness of a broader claimed range can, in certain instances, be proven by a narrower range of data. Often, one having ordinary skill in the art may be able to ascertain a trend in the exemplified data which would allow him to reasonably extend the probative value thereof. The proof, thus considered, might then be sufficient to rebut a PTO holding of prima facie obviousness.

Kollman, 595 F.2d at 58.

In this case, the Appellants have failed to demonstrate that one of ordinary skill in the art would be able to ascertain a trend in the results reported in Examples 1 and 2.

3. The Appellants have failed to establish that Comparative Example 4 (i.e., Maas Example 21) is the closest prior art. *De Blauwe*, 736 F.2d at 705.

The Examiner maintains that Maas Example 4 (i.e., "Chromium complex 3": [(1,3,5-tri-n-dodecyl-1,3,5-triazacyclohexane)$CrCl_3$]) is the

closest prior art because this catalyst "is the same catalyst as recited in claim 1." Ans. 6.

On the other hand, the Appellants argue that Comparative Example 4 (i.e., Maas Example 21) is the closest prior art because this example satisfies more claim limitations (i.e., boron compound, B:Cr molar ratio) than Maas Example 4 (i.e., ligand). The Appellants rely on *In re Merchant*, 575 F.2d 865, 868 (CCPA 1978) for support. Reply Br. 3.

In *Merchant*, the Court explained:

> Given the enormous variety of technologies and claimed subject matter, no all-encompassing principle or test can be delineated for determining the closest prior art. However, an almost self-evident guideline would appear effective in most cases. A comparison of the claimed invention with the disclosure of each cited reference to determine the number of claim limitations in common with each reference, bearing in mind the relative importance of particular limitations, will usually yield the closest single prior art reference.

Merchant, 575 F.2d at 868.

In this case, the Appellants have failed to direct us to any evidence establishing that the particular boron compound and B:Cr molar ratio selected is more important in the claimed process than the particular ligand chosen.

On balance, the evidence of record, including Maas and the Appellants' objective evidence of non-obviousness, does not weigh in favor of a determination that the subject matter of claim 1 is patentable over Maas.

F. DECISION

The decision of the Examiner is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a) (2008).

AFFIRMED

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OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA VA 22314